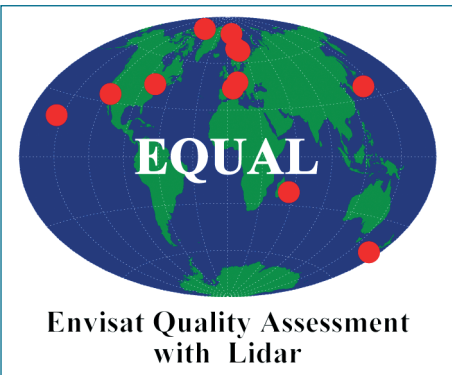


Envisat Quality Assessment with Lidar (EQUAL): a project to support the long-term validation of ozone and temperature profiles



Abstract

ESA started several new projects to support the long-term validation of ENVISAT's three atmospheric chemistry instruments; GOMOS, MIPAS and SCIAMACHY. The EQUAL project assesses the quality of their ozone and temperature profiles by comparison to lidar data from eleven stations worldwide. Besides the required coordination and contribution of the lidar data, this project involves dedicated validation activities to assess ENVISAT's data quality. The main focus will be on the quality of the operational ESA products, but the focus might sometimes be changed toward products of scientific institutes. The vast amount of lidar data allows the analysis for possible dependencies on several geophysical (e.g., latitude) and observational (e.g., star characteristics) parameters.

LIDAR

- Principle:** Ozone and temperature profiles are retrieved with Differential Absorption Lidars (DIAL) and elastic backscatter lidars (laser radar). Typical altitude ranges are 15–48 km (3-km resolution) and 15–75 km (2-km resolution) for zone and temperature profiles, respectively.
- Product availability:** Participating stations (from north to south) are listed in Table 1. Total numbers for submitted files are 1000 for 2003, 1000 for 2004 and in 2005 already over 100.
- NDSC Quality:** All lidar systems in the EQUAL project (except one) are part of the Network for the Detection of Stratospheric Change (NDSC, www.ndsc.ws). Their measurements are regularly monitored for their quality via measurement and algorithm intercomparison campaigns performed under the NDSC protocol. See Table 2, for an overview of expected (systematic and random) errors in the ozone retrieval, and for temperature these errors are 1 and 2 K, respectively.
- Data access:** Lidar ozone and temperature profiles are in the NILU database. For other purposes, please contact the PI.



Table 1. Overview of LIDAR systems: locations and parameters

Groundstation	Lat.	Long.	Parameter	Contr. profiles
Eureka	80.05	-86.42	Ozone, temperature	14, 14
Ny Ålesund	78.92	11.93	Ozone	63
Alomar	69.30	16.00	Ozone	51
Esrang	67.88	21.10	Temperature	51
Hohenpeissenberg	47.80	11.02	Ozone, temperature	257, 247
Obs. Haute Provence	43.94	5.71	Ozone, temperature	280, 220
Toronto	43.66	-79.40	Ozone	5
Tsukuba	36.05	140.13	Ozone, temperature	60, 35
Table Mountain	34.40	-117.70	Ozone, temperature	269, 301
Mauna Loa	19.54	-155.58	Ozone, temperature	325, 345
La Reunion	-21.80	55.50	Ozone, temperature	2, 0
Lauder	-45.04	169.68	Ozone, temperature	207, 0

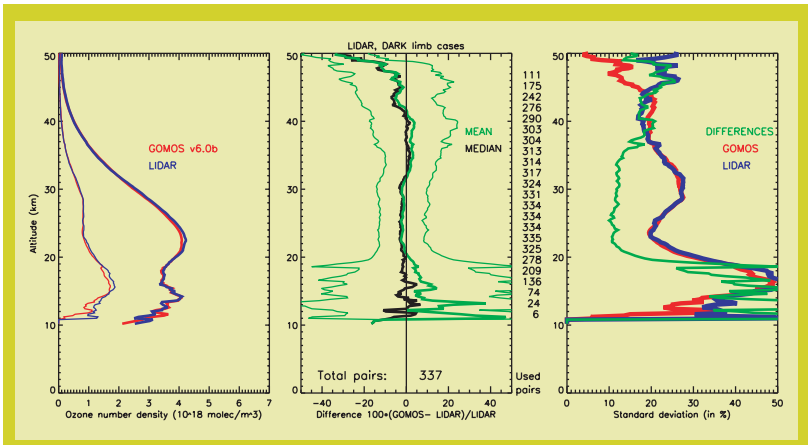
Table 2. Errors (systematic and random) expected within ozone lidar data of the NDSC.

Altitude range	Bias	Variance
<20 km	5%	5%
20-35 km	2%	2%
>35 km	5-10%	5-10%

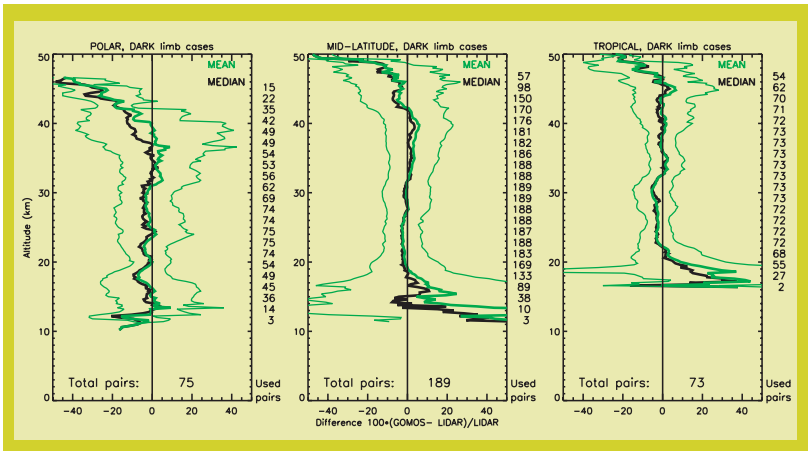
Keckhut *et al.*, Review of ozone and temperature lidar validations performed within the framework of the Network for the Detection of Stratospheric Change, *J. Environ. Monit.*, 6, 721–733, 2004 (Table 3).

GOMOS

- Full Name:** Global Ozone Monitoring by Occultation of Stars.
- Method:** GOMOS is a medium-resolution stellar occultation spectrometer operating in UV-VIS-NIR spectral range. Ozone profile retrieval is typically between 15- and 110-km altitude (2-km resolution).
- Product availability:** Per day about 400 stellar occultations are observed. Dayside observations result in erroneous profiles and should currently be disregarded. From ESA processing (Fin-PAC), 100,000 profiles are available starting May 2004 (IPF version 4.02). From the ESA prototype processing (ACRI), over 100,000 profiles are available covering 2003 (prototype version 6.0b). High-resolution temperature profiles (HRTF) will also be retrieved from GOMOS measurements.
- Results:** Validation results are for 2003 data measured in DARK limb. Results have also been sub-divided per latitude region.
- Conclusions:** In dark limb GOMOS agrees very well with LIDAR, with 2.5–7.5% bias (STD ~14%) in 14–64 km range. See also *Meijer et al.*; “Pole-to-pole validation of Envisat GOMOS ozone profiles using data from ground-based and balloon sonde measurements”, *J. Geophys. Res.*, 2004JD004834, 2004.



OZONE comparison of averaged GOMOS ESA v6.0b and LIDAR results (collocations within 800 km and 20 hrs).



LATITUDE: GOMOS quality in Polar, Mid-latitude and Tropical regions.